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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/665,040	09/18/2003	Warren Lin	26571-502	4471
7590	02/15/2005		EXAMINER	
Brian P. Hopkins, Esq. MINTZ, LEVIN, COHN, FERRIS, GLOVSKY AND POPEO, P. The Chrysler Center 666 Third Avenue, 24th Floor New York, NY 10017			BURCH, MELODY M	
		ART UNIT	PAPER NUMBER	
		3683		
DATE MAILED: 02/15/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/665,040	LIN, WARREN
	Examiner	Art Unit
	Melody M. Burch	3683

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 06 January 2005.

2a) This action is FINAL. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 1-29 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 1-29 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on 18 September 2003 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:

1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) Notice of References Cited (PTO-892)
 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
 Paper No(s)/Mail Date _____.

4) Interview Summary (PTO-413)
 Paper No(s)/Mail Date. _____.

5) Notice of Informal Patent Application (PTO-152)
 6) Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to because in figure 1B "104a" is not pointing to a bottom surface as described in the specification. Also "300" in figure 3A fails to point to a particular object. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.
2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: element 112a mentioned in line 18 of pg. 6, element 308 mentioned in line 3 of pg. 10, element 316 mentioned in line 6 of pg. 10. Corrected drawing sheets in

compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the vehicle recited in line 1 of claim 26 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an

application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

4. In addition to Replacement Sheets containing the corrected drawing figure(s), applicant is required to submit a marked-up copy of each Replacement Sheet including annotations indicating the changes made to the previous version. The marked-up copy must be clearly labeled as "Annotated Marked-up Drawings" and must be presented in the amendment or remarks section that explains the change(s) to the drawings. See 37 CFR 1.121(d). Failure to timely submit the proposed drawing and marked-up copy will result in the abandonment of the application.

Claim Objections

5. Claims 5 and 8 are objected to because of the following informalities: the phrase "at least one of the plurality of the ribs are" in line 2 of claim 5 should be changed to --at least one of the plurality of the ribs is--; the phrase "the central portion" in line 2 of claim 8 should be changed to --the central mounting portion-- to maintain consistency. Appropriate correction is required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

7. Claim 5 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re: claim 5. The phrase "a brake rotor" in lines 2-3 is indefinite. It is unclear to the Examiner whether the phrase is intended to be the same or different from the brake rotor in claim 1.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. Claims 1, 2, 5, 7, 9, 11-17, 19-21, 26-29 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 4913266 to Russell et al.

Re: claims 1, 22, and 26. Russell et al. show in figure 2 a brake rotor shown in the area of element 5 comprising a central mounting portion or mounting bore in top element 9 for mounting the brake rotor on a hub 1, a first annular braking surface to the left of the lead line of number 3 and a second annular braking surface 5, wherein each braking surface includes an inner diameter and an outer diameter, a bridge or solid portion of top element 9 provided between the central mounting portion and the inner

diameter of at least one of the first and the annular braking surfaces, and a plurality of ribs or remaining elements 9 positioned proximate to the bridge wherein the central mounting portion, the braking surfaces, the bridge , and the ribs are formed in a single piece as shown in figure 2.

Re: claim 2. Russell et al. show in figure 2 the limitation wherein the bridge 9 is substantially solid and wherein at least a portion of at least one rib (remaining elements 9) protrudes above a surface (particularly a bottom surface) of the bridge.

Re: claim 5. Russell et al. show in figure 2 the limitation wherein at least one of the plurality of ribs are integral to a side of a flow channel shown between elements 7 of a vented brake rotor.

Re: claims 7, 9. Russell et al. show in figure 2 the brake rotor comprising one or more pairs of openings or areas between elements 7, each pair of openings allowing communication between the first annular braking surface and the second annular braking surface or in an alternate interpretation the one or more pairs of openings may be the holes in the ribs 9. In the alternate interpretation the vent would be the space between adjacent elements 7.

Re: claims 11, 19, 23, 27. Russell et al. show a cover or rightmost element shown above fastener 17 for covering all or a portion of the bridge.

Re: claim 14. Russell et al. show in figure 2 a brake rotor shown in the area of element 5 comprising a central mounting portion or mounting bore in top element 9 for mounting the brake rotor on a hub 1, a first annular braking surface to the left of the lead line of number 3 and a second annular braking surface 5, wherein each braking surface

includes an inner diameter and an outer diameter, a bridge or remaining portion of top element 9 provided between the central mounting portion and the inner diameter of at least one of the first and the annular braking surfaces, a plurality of ribs or remaining elements 9 positioned proximate to the bridge (in an alternate interpretation elements 7 can represent ribs proximate the bridge), and a plurality of flow channels shown between elements 7.

Re: claim 15. Russell et al. show in figure 2 the limitation wherein each flow channel includes at least one wall 7.

Re: claims 16 and 17. Russell et al. show in figure 2 in the alternate interpretation the limitation wherein the at least one wall comprises one of the plurality of ribs.

10. Claims 1, 3, 5, and 7-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Russell et al. (ALTERNATE INTERPRETATION).

Re: claims 1, 22, and 26. In an alternate interpretation of the Russell et al. reference, Russell et al. show in figure 2 a brake rotor shown in the area of element 5 comprising a central mounting portion or element 1 for mounting the brake rotor on a hub shown immediately to the left of the lead arrow of number 15, a first annular braking surface to the left of the lead line of number 3 and a second annular braking surface 5, wherein each braking surface includes an inner diameter and an outer diameter, a bridge or all elements 9 provided between the central mounting portion and the inner diameter of at least one of the first and the annular braking surfaces, and a plurality of ribs 7 positioned proximate to the bridge.

Russell et al. include the limitation wherein the central mounting portion, the braking surfaces, the bridge, and the ribs are formed in a single piece under assembly via the elements 15.

Re: claims 3 and 18. Russell et al. show in figure 2 the limitation wherein the rotor comprises a plurality of openings positioned in the bridge or the apertures shown in each of elements 9.

Re: claim 5. Russell et al. show in figure 2 the limitation wherein at least one of the plurality of ribs are integral to a side of a flow channel shown between elements 7 of a vented brake rotor.

Re: claims 7, 9. Russell et al. show in figure 2 the brake rotor comprising one or more pairs of openings or areas between elements 7, each pair of openings allowing communication between the first annular braking surface and the second annular braking surface or in an alternate interpretation the one or more pairs of openings may be the holes in the elements 9. In the alternate interpretation the vent would be the space between adjacent elements 7.

Re: claims 8 and 10. In the alternate interpretation, Russell et al. show the limitation wherein the central mounting portion comprises a hat having a plurality of openings shown on elements 13 which may be used to receive fasteners from hub shown to the left of number 15.

Re: claims 11, 19, 23, and 27. Russell et al. show the limitation wherein the rotor further comprises a cover or element shown to the right of the lead arrow of number 15 for covering all or a portion of the bridge.

Re: claims 12, 20, 24, and 28. Russell et al. show in figure 2 the limitation wherein the cover comprises a circular piece of material having a central opening corresponding in size to the central mounting portion of the rotor, wherein upon mounting of the cover onto the rotor, the central opening receives the central mounting portion of the rotor.

Re: claims 13, 21, 25, and 29. Russell et al. show in figure 2 the limitation wherein the cover includes a plurality of fastening openings shown at 27 for receiving fasteners for fastening the cover to the rotor.

Re: claim 14. Russell et al. show in figure 2 a brake rotor shown in the area of element 5 comprising a central mounting portion or element 1 for mounting the brake rotor on a hub, a first annular braking surface to the left of the lead line of number 3 and a second annular braking surface 5, wherein each braking surface includes an inner diameter and an outer diameter, a bridge or all of elements 9 provided between the central mounting portion and the inner diameter of at least one of the first and the annular braking surfaces, a plurality of ribs 7 positioned proximate to the bridge, and a plurality of flow channels shown between elements 7.

Russell et al. include the limitation wherein the central mounting portion, the braking surfaces, the bridge, and the ribs are formed in a single piece under assembly via the elements 15.

Re: claim 15. Russell et al. show in figure 2 the limitation wherein each flow channel includes at least one wall 7.

Re: claims 16 and 17. Russell et al. show in figure 2 in the alternate interpretation the limitation wherein the at least one wall comprises one of the plurality of ribs.

11. Claims 1, 2, 5-9, 14, 15, 17, 22, and 26 are rejected under 35 U.S.C. 102(e2) as being anticipated by US Patent 6536564 to Garfinkel et al.

Re: claims 1, 2. Garfinkel et al. show in figure 6 a brake rotor 110 comprising a central mounting portion 124 for mounting the brake rotor on a hub, a first annular braking surface and a second annular braking surface, wherein each braking surface includes an inner diameter and an outer diameter, a bridge 122 provided between the central mounting portion and the inner diameter of at least one of the first and the annular braking surfaces, and a plurality of ribs 144 positioned proximate to the bridge.

Re: claim 5. Garfinkel et al. show in figure 6 the limitation wherein at least one of the plurality of ribs 144 is integral to a side of a flow channel 130a of a brake rotor.

Re: claim 6. Garfinkel et al. show in figure 6 the limitation wherein either or both of the annular braking surfaces includes one or more slots 117.

Re: claim 7. Garfinkel et al. show in figure 6 the limitation of the rotor further comprising one or more pairs of openings (the opening within the bridge 122, the opening in the area of element number 126 and the pairs of openings shown at 138 and 140, for example, each pair of opening allowing communication between the first annular braking surface and the second annular braking surface.

Re: claim 8. Garfinkel et al. show in figure 6 the limitation of the rotor further comprising a hat portion shown in the area of element 126 disposed in the central portion and adapted for mounting the rotor to a vehicle.

Re: claim 9. Garfinkel et al. show in figure 6 the limitation wherein a first opening or hole within element 122 allows the first annular braking surface to fluid communicate with a vent 130a.

Re: claims 14, 15, 17, 22, and 26. Garfinkel et al. show in figure 6 a brake rotor comprising a central mounting portion 124 for mounting the brake rotor on a hub, a first annular braking surface and a second annular braking surface , wherein each braking surface includes an inner diameter and an outer diameter, a bridge 122 provided between the central mounting portion and the inner diameter of at least one of the first and the annular braking surfaces, a plurality of ribs 144 positioned proximate to the bridge, and a plurality of flow channels 130a.

12. Claims 1, 3, 4, 8, 22, and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by DE-3216108 (DE'108).

Re: claims 1, 22, and 26. DE'108 shows in figure 1 a brake rotor 3 comprising a central mounting portion 2 for mounting the brake rotor on a hub, a first annular braking surface and a second annular braking surface, wherein each braking surface includes an inner diameter and an outer diameter, a bridge 27,29 provided between the central mounting portion and the inner diameter of at least one of the first and the annular braking surfaces, and a plurality of ribs 26 positioned proximate to the bridge.

DE'108 includes the limitation wherein the central mounting portion, the braking surfaces, the bridge, and the ribs are formed in a single piece under assembly via the element 29 as shown in figure 1.

Re: claim 3. DE'108 shows in figure 1 the limitation wherein the bridge includes a plurality of openings or spaces enclosed by elements 27 and element 29.

Re: claim 8. DE'108 shows in figure 1 the limitation of the rotor further comprising a hat portion or inner cylindrical wall of element 2 disposed in the central portion and adapted for mounting the rotor to a vehicle.

Re: claims 1 and 4. In an alternate interpretation, DE'108 shows in figure 1 a brake rotor 3 comprising a central mounting portion 2 for mounting the brake rotor on a hub, a first annular braking surface and a second annular braking surface, wherein each braking surface includes an inner diameter and an outer diameter, a bridge 26,29 provided between the central mounting portion and the inner diameter of at least one of the first and the annular braking surfaces, and a plurality of ribs 27 positioned proximate to the bridge.

DE'108 includes the limitation wherein the central mounting portion, the braking surfaces, the bridge, and the ribs are formed in a single piece under assembly via the element 29 as shown in figure 1.

Response to Arguments

13. Applicant's arguments filed 1/6/05 have been fully considered but they are not persuasive.

With regards to the drawing objections, Examiner maintains the drawing objections since the new formal drawings discussed on pg. 9 of the Remarks were not located in the file by the Examiner.

With regards to the rejections on the merits, Applicant has amended the independent claims to recite that the central mounting portion, the braking surfaces, the bridge and the ribs are formed in a single piece. Examiner notes that a bicycle, for example, is an assembly of multiple components formed in a single piece. To the same extent that assembled bicycle components are formed in a single piece, the assembled rotor components of Russell et al. and DE'108 are formed in a single piece as broadly claimed.

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Melody M. Burch whose telephone number is 703-306-4618. The examiner can normally be reached on Monday-Friday (7:30 AM-4:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles A. Marmor can be reached on 703-308-0830. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

mmmb 2/9/05
February 9, 2005

M. C. Graham
2-10-2005
MATTHEW C. GRAHAM
PRIMARY EXAMINER
GROUP 310

3216108

Nummer:
Int. Cl.³:
Anmelddetag:
Offenlegungstag:

3216108
F16D 65/12
30. April 1982
30. Dezember 1982

30.04.
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For
Primary
Review
only

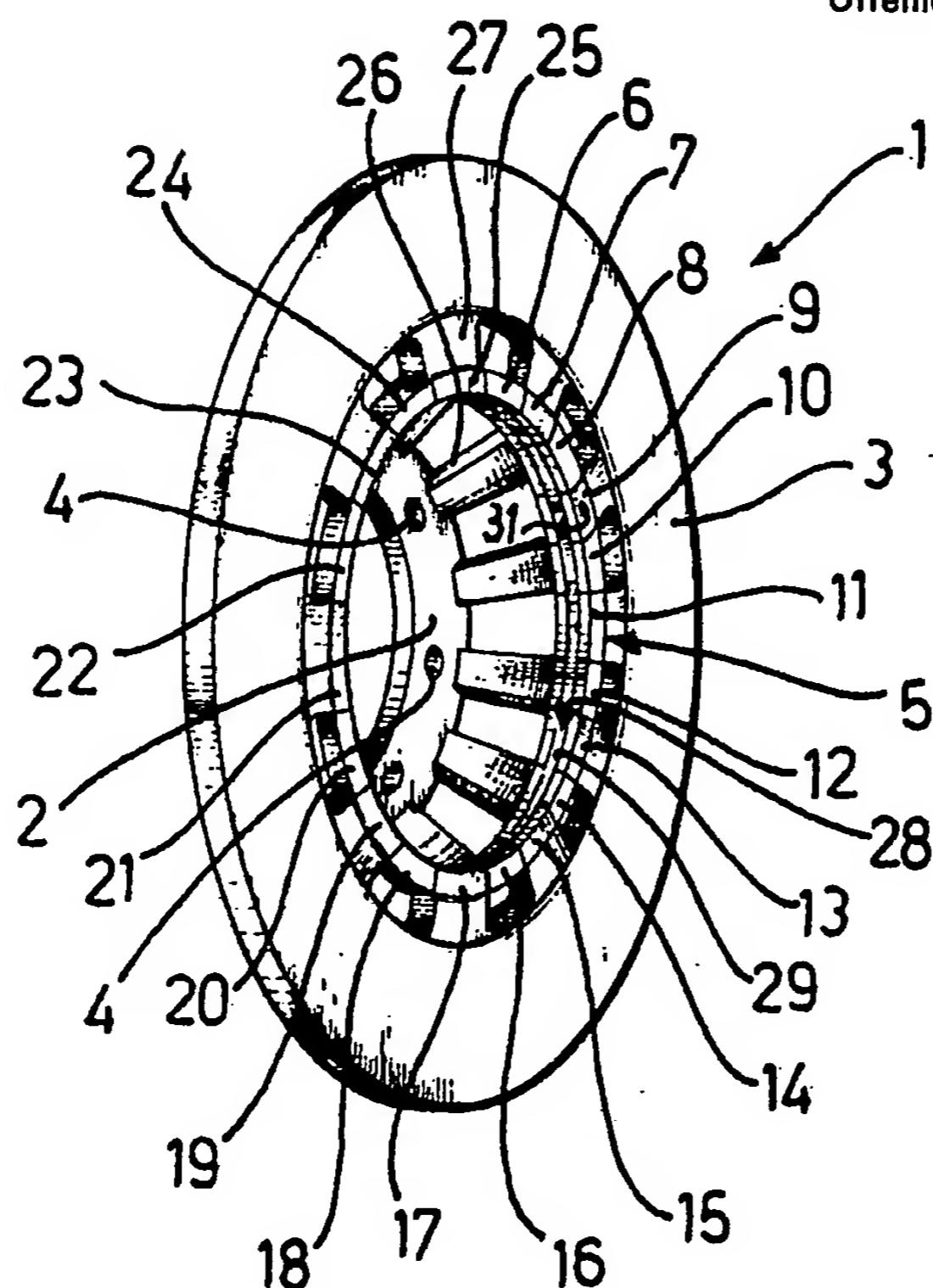


Fig-1

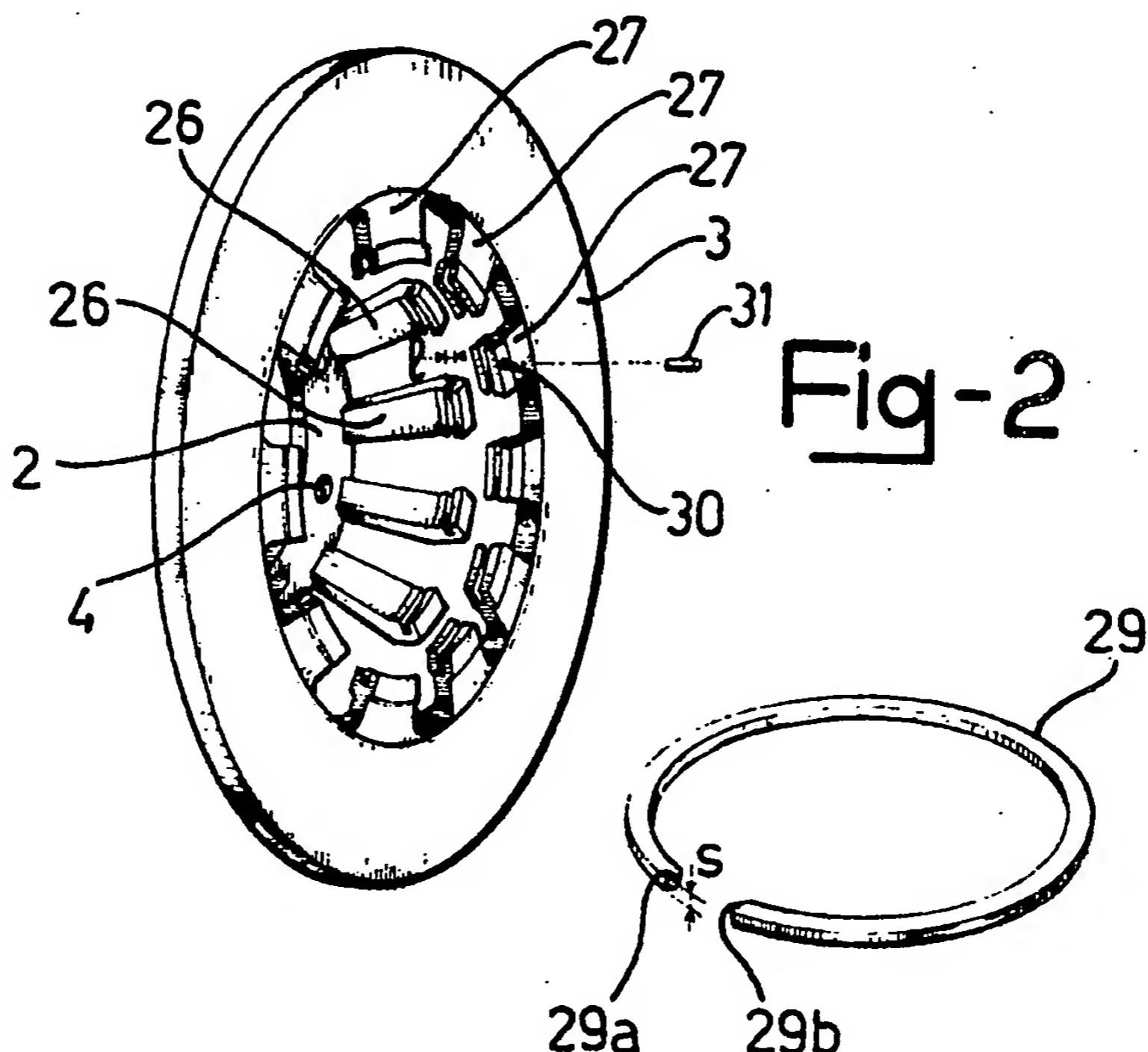


Fig-2

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Brembo S.p.A.

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Primary
Review
only



US006536564B1

(12) **United States Patent**
Garfinkel et al.

(10) Patent No.: **US 6,536,564 B1**
(45) Date of Patent: **Mar. 25, 2003**

(54) **VENTED DISC BRAKE ROTOR**

(75) Inventors: **George Albert Garfinkel**, Westland, MI (US); **Douglas Charles Myers**, Canton, MI (US); **Nicholas James Gianaris**, West Bloomfield, MI (US); **Syed Amir A. Hashmi**, Canton, MI (US)

5,544,726 A	8/1996	Topouzian et al.
5,706,915 A	1/1998	Shimazu et al.
5,878,848 A	3/1999	Zhang
6,119,820 A	9/2000	Steptoe et al.
6,142,267 A	11/2000	Sporzynski et al.
6,216,829 B1	4/2001	Daudi
6,234,282 B1	5/2001	Martin
6,260,669 B1	7/2001	Daudi
6,308,808 B1	10/2001	Krenkel et al.

(73) Assignee: **Visteon Global Technologies, Inc.**, Dearborn, MI (US)

* cited by examiner

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

Primary Examiner—Christopher P. Schwartz

(74) Attorney, Agent, or Firm—Brinks Hofer Gilson & Lione

(21) Appl. No.: **10/097,887**

ABSTRACT

(22) Filed: **Mar. 14, 2002**

A vented disc brake rotor is provided. In one embodiment, the rotor includes a plurality of curved directing walls disposed between first and second braking surfaces to define a plurality of flow channels. A separating wall is disposed in each flow channel to create first and second subchannels. The total cross-sectional area of each flow channel remains substantially constant over the length of the flow channel. The flow channels can be closed to the two braking surfaces. Alternatively, the braking surfaces can be intermittent, defining a plurality of gaps that provide access to the flow channels. A tapered throat region between the braking surfaces and a hat region facilitates dissipation of heat from the braking surfaces. Rotors according to the present invention can be fabricated in a single step using various conventional casting techniques, such as die-, sand- and squeeze-casting.

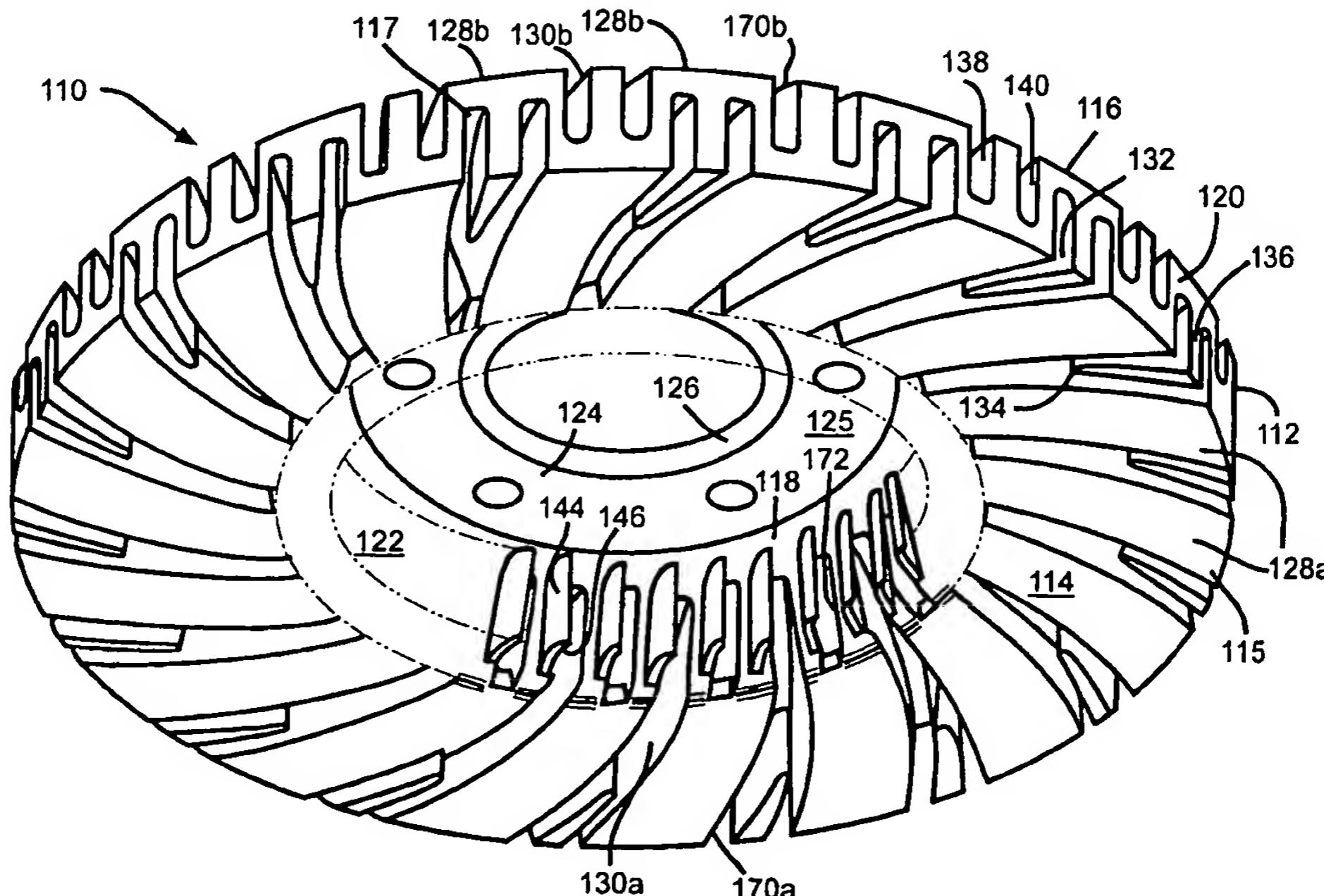
(51) Int. Cl.⁷ **F16D 65/78; F16D 65/12**
(52) U.S. Cl. **188/264 A; 188/218 XL**
(58) Field of Search **188/18 A, 218 A, 188/218 XL, 264 A, 264 AA**

20 Claims, 6 Drawing Sheets

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,623,577 A	11/1971	Scharlack
4,448,291 A	5/1984	Ritsema et al.
4,470,485 A	9/1984	Warwick
4,811,822 A	* 3/1989	Estaque 188/264 A
5,279,396 A	* 1/1994	Estaque et al. 188/264 A
5,427,212 A	* 6/1995	Shimazu et al. 188/218 XL



FOR
Primary
Review
Only

United States Patent [19]

Russell et al.

[11] Patent Number: 4,913,266
[45] Date of Patent: Apr. 3, 1990

[54] **DISC BRAKES**

[75] Inventors: David F. Russell, Mickle Trafford; Simon B. Dobson, Birkenhead; Alexander J. Williams, Crosby, all of England

[73] Assignee: Lucas Industries public limited company, Birmingham, England

[21] Appl. No.: 248,443

[22] Filed: Sep. 23, 1988

[30] Foreign Application Priority Data

Sep. 23, 1987 [GB] United Kingdom 8722349

[51] Int. Cl. ⁴ F16D 65/12

[52] U.S. Cl. 188/18 A; 188/218 XL; 188/264 A; 192/70.13; 192/106.1; 403/291; 464/78; 464/99

[58] Field of Search 188/218 XL, 264 A, 264 AA, 188/18 A; 192/70.13, 106.1; 403/291; 464/78, 81, 98, 99, 160; 267/160

[56] References Cited

U.S. PATENT DOCUMENTS

1,216,307 2/1917 Guthrie 464/98 X
1,460,212 6/1923 Olive 464/98
2,256,712 9/1941 Hunt 192/106.1 X
2,753,959 7/1956 Johnson 188/218 XL
2,908,358 10/1959 Erickson 188/218 XL X
3,661,235 5/1972 Harrison 188/218 XL

4,353,444 10/1982 Bionaz 192/106.1 X
4,501,346 2/1985 Bogenschutz 188/218 XL
4,641,731 2/1987 Kawaguchi et al. 188/218 XL

FOREIGN PATENT DOCUMENTS

3216108 12/1982 Fed. Rep. of Germany 188/218 XL
1562996 3/1969 France 188/218 AL
444231 1/1949 Italy 188/18 A
2172676 9/1986 United Kingdom 188/218 XL

Primary Examiner—George E. A. Halvosa
Attorney, Agent, or Firm—Scrivener and Clarke

[57] ABSTRACT

The present specification discloses a braking disc for a disc brake. The braking disc comprises an annular disc member with a number of radially inwardly projecting lugs, located coaxially with respect to a central hub member which has a number of radially outwardly projecting lugs, the lugs on the hub member being located between adjacent lugs on the annular disc member. The lugs on said members are interconnected by at least one resilient member which is designed to flex generally radially but not circumferentially. Thus the or each resilient member positively transmits circumferential torque forces but is sufficiently flexible to allow for radial deflection due to thermal expansion of the disc member, without being over-stressed.

8 Claims, 3 Drawing Sheets

